Magazine article

Implications for engineering organisations post the Pike-River disaster

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While the final sequences of an accident always involve physics, the root causes are often in the realm of behaviour, especially the actions taken by managers and workers.

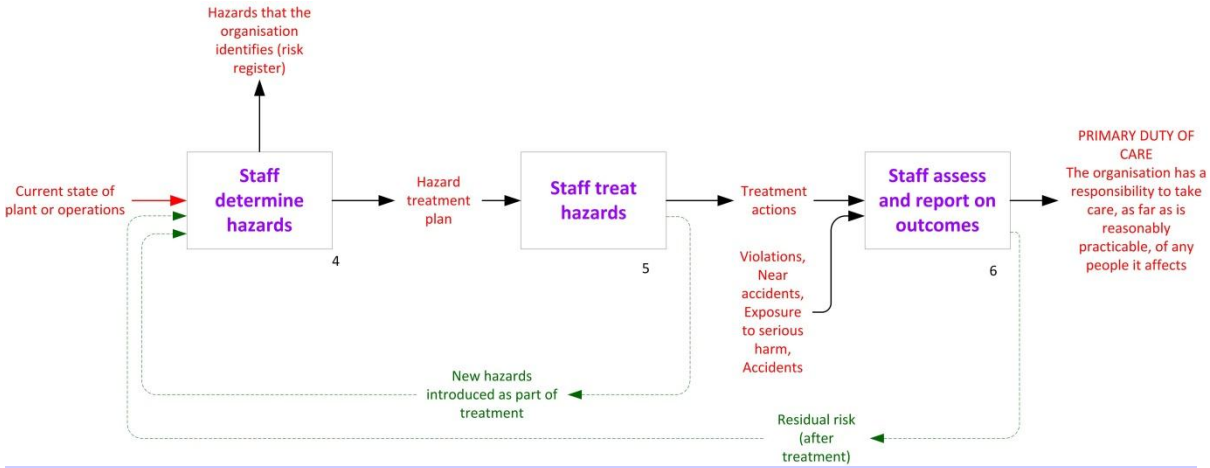
In the case of the Pike River Mine the physical accident involved an explosion of methane gas, which is naturally liberated from coal. There was no shortage of possible ignition sources, ranging from worker violations (cell phones, watches), diesel engines, electrical arcing, and power electronics. Some poor engineering decisions were made regarding electrical systems in particular. However a small methane explosion could have been survivable, but not the series of large explosions that actually occurred. Consequently part of the problem was excessive methane in the mine. In turn this was caused by the mismatch between the increased methane caused by accelerated coal extraction (made necessary by cash-flow problems), and insufficient withdrawal of methane by the fan ventilation system. The problems with the ventilation system included imprudent engineering system design (placement of fan inside the mine), insufficient ventilation capacity, and management prioritisation of production over solving ventilation problems.

Fundamentally the company had insufficient funds to set up a venture of that complexity while still managing the risks. It is understandable that firms do not have perfect knowledge when they start a venture, but they also do need to have the courage to stop when new information becomes available that shows the risks to be greater than the benefits.

It was not possible to secure a conviction against any board directors or executives of the mining company. Basically they all claimed they were not aware of the hazards. The law was subsequently changed to close this defence,

by imposing new duties. Now an organisation has a **Primary duty of care** to take care, as far as is reasonably practicable, of any people it affects: its workers, all the workers of any subcontractors (workers of other organisations that do work on the site), trainees, visitors, and the public at large. This responsibility extends to providing a safe work environment, having safe equipment and facilities, having protocols, storing materials safely, training workers, and monitoring the health of workers. In particular, note that the duty extends to all workers, whoever employs them, including those of sub-contractors.

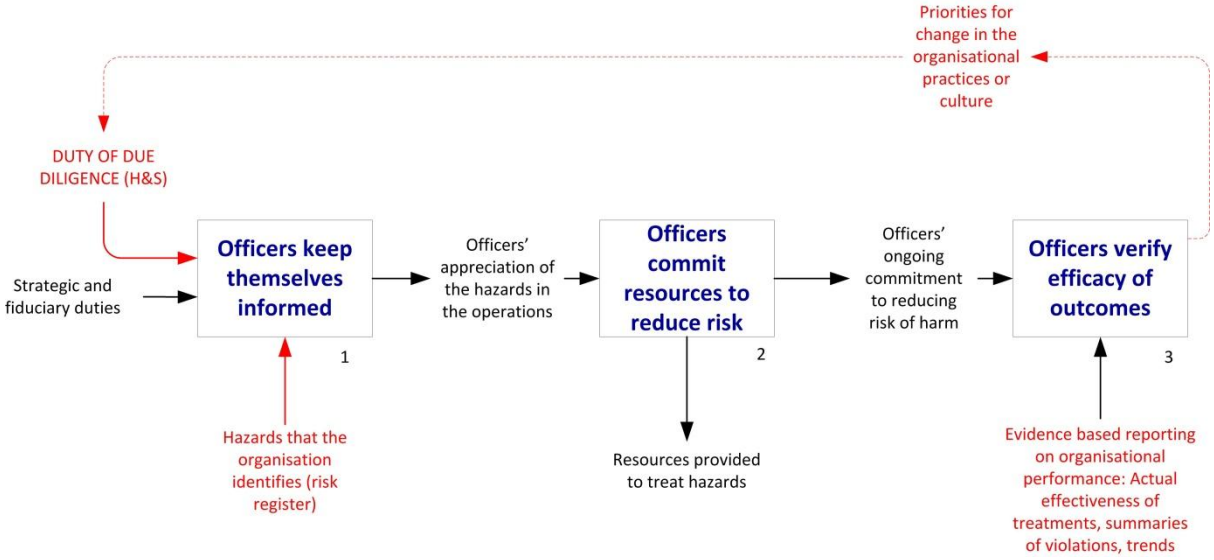
In the past the engineering and technical staff were primarily responsible for the locus of action for hazard management. They were expected to apply the risk assessment methodology to identify hazards, rank them, and apply treatment. Those treatments were formulated in terms of a hierarchy of hazard control: eliminate, isolate, minimise. That work stream survives into the new Act, except that it only refers to elimination and minimisation (the difference is not significant).



TECHNICAL WORK STREAM: The typical organisational approach to hazards is based on technical staff determining the hazards, treating them, and assessing the outcomes. The process needs to be robust enough to detect when new hazards are introduced as part of treatment, and to assess the residual risk after treatment. Image D Pons.

However a major change occurred in the additional work stream required of all directors and executives ('officers'). The **Duty of Due Diligence** requires officers to make themselves informed of hazards and ensure that the organisation is dealing with them effectively. Ignorance of the hazards faced by workers is no longer a defence, but is instead an offense in its own right. Nor

can officers delegate the duty. Even though they can task others in the organisation to implement the health and safety treatments, the officers still retain responsibility for the outcomes. The act effectively elevates health and safety considerations to the same level as the strategic and fiduciary duties that already apply to boards.

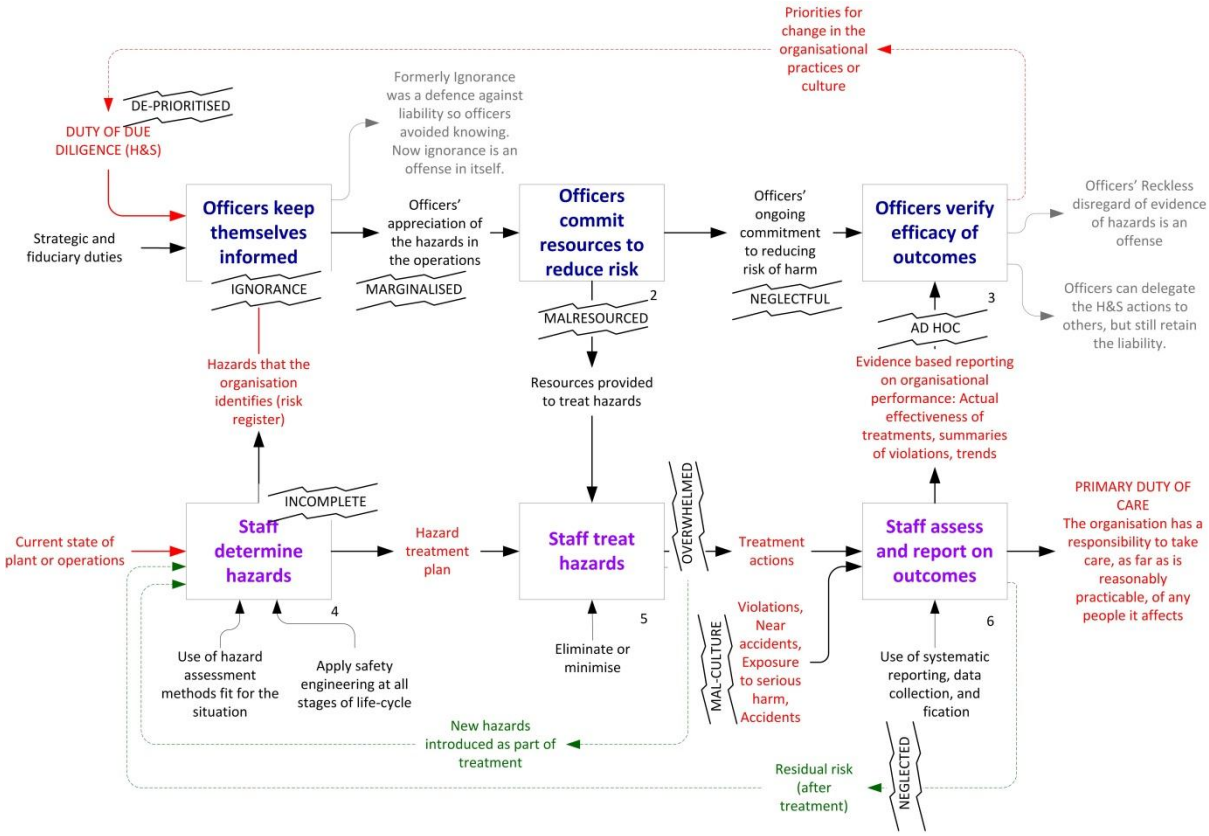


OFFICERS' WORK STREAM: Directors and Executives are now required to keep themselves informed about hazards in their organisation, show ongoing commitment to reduction of harm, and apply diligence to verify the state of the organisation's processes. Image D Pons.

As a consequence prudent directors and executives of technology-based organisations will need to assess their current practices, and make changes to their systems to remedy deficiencies. They will need systems to collect evidence-based statistics on organisational performance: actual effectiveness of treatments, summaries of violations, trends in safety incidents. Officers will need to take note of these reports, and exert personal agency to fix the issues and change the organisational practices and culture where necessary.

Another important change is that the new Act does not preserve the category of 'serious harm'. Instead the new Act defines a 'notifiable incident' as merely the *exposure* to serious harm, *whether or not serious harm actually occurs.* As the term suggests, such near accidents must now be notified to the Regulator, and can arise in penalties. In the old way of thinking a 'near-miss' did not have much consequence under law, and thus did not always encourage people to preventative agency. Now with the new law it would be prudent for organisations to learn to articulate these as 'near-accidents'. It may require a culture change to achieve this shift.

Were a similar accident to occur now, the directors and executives would be exposed to criminal charges for neglecting their duties in multiple areas. The diagram illustrates some of the common weaknesses: incomplete hazard assessments, under-resourced treatment plans, processes that are overwhelmed by the number of incidents, neglect of introduced and residual risks, poor culture towards violations, ad-hoc or lack of reporting of safety statistics to the board. These are known barriers to effective risk management at the engineering level. Organisations absolutely are expected to be competent at these processes, since the risk assessment process is well-established.



NEW EXPECTATIONS: If a similar accident were to occur now, the directors and executives ('Officers') would be guilty on multiple counts, for being negligent regarding their 'duty of due diligence' and for failing to ensure that the organisation met its 'primary duty of care'. Image D Pons.

However the *new* risk for organisations is that the Act deliberately criminalises deficiencies in judgement at the board level. The diagram shows the types of deficiencies that could result in liability under the Act. This is a new concept and for some organisations will require a change in attitudes and priorities of

directors and executives. The risk is real: the consequences are serious financial and criminal penalties, and the likelihood of these is high. In summary, organisations will need to strengthen the integrity of their risk management processes at engineering and operational levels, and also at board level.

Dirk Pons (PhD, CPEng) is a Senior Lecturer at the University of Canterbury. His research interests include risk, reliability, human error, safety, along with design, manufacturing engineering, engineering management, and professional practice. He is a founder member of the New Zealand Society of Safety Engineering, and was instrumental in contributing to the development of a well-received course on 'Safety engineering' for the Institution of Professional Engineers New Zealand (IPENZ). He was a member of the standards committee that created the AS/NZS risk management standard. He serves on the Standards and Accreditation Board of IPENZ.